

***What Is Claimed Is:***

1. A ball grid array (BGA) package, comprising:  
a substrate that has a first surface and a second surface;  
a stiffener that has a first surface and a second surface, wherein said  
5 second stiffener surface is attached to said first substrate surface;  
an IC die that has a first surface and a second surface, wherein said first  
IC die surface is mounted to said first stiffener surface;  
a heat spreader that has a first surface, wherein said first heat spreader  
surface is mounted to said second IC die surface; and  
10 a plurality of solder balls attached to said second substrate surface.

2. The package of claim 1, wherein said heat spreader is configured  
to dissipate heat generated by said IC die.

3. The package of claim 1, wherein said IC die is mounted to said  
first stiffener surface with an epoxy.

15 4. The package of claim 3, wherein said epoxy is a silver filled  
epoxy.

5. The package of claim 3, wherein an area of said second IC die  
surface is greater than an area of said first heat spreader surface, wherein said heat  
spreader is configured to mount to the center of said second IC die surface.

20 6. The package of claim 1, further comprising:  
an exposed first surface of the BGA package, wherein said heat spreader  
has a second surface that forms a portion of said exposed first surface of the BGA  
package.

7. The package of claim 1, wherein said heat spreader is internal to the BGA package.

8. The package of claim 1, wherein said substrate is a tape substrate.

9. The package of claim 1, wherein said plurality of solder balls are located outside an outer dimensional profile of said IC die.

10. A ball grid array (BGA) package, comprising:  
a substrate that has a first surface and a second surface;  
a stiffener that has a first surface and a second surface, wherein said first stiffener surface is attached to said first substrate surface;

an integrated circuit (IC) die that has a first surface and a second surface, wherein said first IC die surface is mounted to said second stiffener surface, wherein said second IC die surface includes a contact pad,

a wire bond corresponding to said contact pad, wherein each said wire bond couples said corresponding contact pad to said second stiffener surface;

at least one solder ball attached to said second substrate surface, wherein each of said at least one solder ball is coupled to said stiffener through a corresponding via extending through said substrate, wherein said at least one solder ball is coupled to a first potential.

11. The package of claim 10, wherein said substrate includes a metal layer, wherein said metal layer is coupled to a second potential;

wherein said stiffener has at least one opening extending from said first stiffener surface to said second stiffener surface;

wherein said second IC die surface includes a second contact pad, wherein the package further comprises:

a second wire bond corresponding to said second contact pad, wherein said second wire bond couples said corresponding second contact pad to said

metal layer by extending through one of said at least one openings in said stiffener, and connecting to a corresponding second via that extends through said substrate.

5           12.     The package of claim 10, wherein said first potential is a ground potential, wherein said first contact pad is a ground contact pad, whereby said stiffener serves as a ground plane.

          13.     The package of claim 10, wherein said substrate is a tape substrate.

10           14.     A ball grid array (BGA) package, comprising:  
            a substrate that has a first surface and a second surface;  
            a stiffener that has a first surface and a second surface, and wherein said second stiffener surface is attached to said first substrate surface; and  
            a plurality of solder balls attached to said second substrate surface;  
            wherein said substrate has a window opening that exposes a portion of said second stiffener surface;  
15           wherein said exposed portion of said second stiffener surface is configured to be coupled to a printed circuit board (PCB).

          15.     The package of claim 14, further comprising:  
            a heat spreader that allows for said exposed portion of said second stiffener surface to be coupled to the PCB.

20           16.     The package of claim 15, wherein said heat spreader has a first surface and a second surface, wherein said first heat spreader surface is coupled to said exposed portion of said second stiffener surface, wherein said second surface of said heat spreader is configured to be coupled to the PCB.

17. The package of claim 16, wherein said first heat spreader surface is plated with solder that allows said first heat spreader surface to be surface mounted to soldering pads on the PCB.

5 18. The package of claim 14, wherein said stiffener has a centrally-located cavity shaped portion that protrudes through said window opening, wherein a surface of said cavity shaped portion forms at least a portion of said exposed portion of said second stiffener surface.

10 19. The package of claim 17, wherein said surface of said cavity shaped portion is plated with solder that allows said stiffener to be surface mounted to at least one soldering pad on the PCB.

20. The package of claim 14, wherein said stiffener is coupled to a first potential, wherein said package further comprises:

an integrated circuit (IC) die that is mounted to said first stiffener surface.

15 21. The package of claim 20, wherein said IC die has a surface that includes at least one ground pad, wherein said package further comprises:

a ground wire bond corresponding to each of said at least one ground pad, wherein each said ground wire bond couples said corresponding ground pad to said first surface of said stiffener.

22. The package of claim 14, wherein said substrate is a tape substrate.

20 23. A ball grid array (BGA) package, comprising:

a substrate that has a first surface and a second surface, wherein said second substrate surface includes an array of contact pads;

a stiffener that has a first surface and a second surface, wherein said second stiffener surface is attached to said first substrate surface;

a plurality of solder balls attached to said contact pads of said substrate;  
and

a metal ring attached to said first stiffener surface, whereby said metal ring improves heat dissipation from said stiffener.

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24. The package of claim 23, wherein said package further comprises:  
an integrated circuit (IC) die that is mounted to said first stiffener surface.

25. The package of claim 23, wherein said substrate is a tape substrate.

26. A ball grid array (BGA) package, comprising:

a substrate that has a first surface and a second surface, wherein said  
second substrate surface includes an array of contact pads;

a plurality of solder balls attached to said contact pads of said substrate;  
and

a stiffener that includes:

a first surface that has an integrated circuit (IC) die mount  
position, wherein the IC die mount position is configured to mount an IC die,

a second surface that is attached to said first substrate surface,

a wire bond opening positioned along an edge of the IC die mount  
location, wherein said wire bond opening extends through said stiffener, and

at least one stud corresponding to said wire bond opening, wherein  
said at least one stud bridges said stiffener across said corresponding said wire  
bond opening.

27. The package of claim 26, wherein said package further comprises:  
an integrated circuit (IC) die that is mounted to said first stiffener surface

IC die mount position.

28. The package of claim 26, wherein said substrate is a tape substrate.

29. A ball grid array (BGA) package, comprising:

a substrate that has a first surface and a second surface, wherein said second substrate surface includes an array of contact pads, wherein said first substrate surface is configured to mount an integrated circuit (IC) die;

a plurality of solder balls attached to said contact pads of said substrate; and

a heat spreader that has a first surface coupled to said second substrate surface, wherein a second surface of said heat spreader is configured to be coupled to a printed circuit board (PCB).

30. The package of claim 29, further comprising at least one via that extends through said substrate, wherein each said at least one via is filled with a conductive material to couple said first substrate surface to said heat spreader.

31. The package of claim 30, further comprising:

a plated die-attach pad centered on the first substrate surface, wherein said die-attach pad is configured to mount the IC die;

a plated plane centered on the second substrate surface, wherein said first heat spreader surface is coupled to said second substrate surface through said plated plane;

wherein said conductive material couples said first substrate surface to said heat spreader by coupling said die-attach pad to said plated plane.

32. The package of claim 29, wherein said substrate is an organic substrate.

33. The package of claim 29, wherein said package further comprises: an integrated circuit (IC) die that is mounted to said first substrate surface.

34. A method of assembling a ball grid array (BGA) package, comprising the steps of:

providing a tape substrate that has a first surface and a second surface;  
attaching a first surface of a stiffener to the first substrate surface;  
mounting an IC die to the second stiffener surface;  
mounting a heat spreader to the IC die; and  
attaching a plurality of solder balls to the second substrate surface.

35. The method of claim 34, wherein said heat spreader mounting step comprises the step of:

causing thermal stress to be reduced at an interface of the IC die and the first stiffener surface during operation of the IC die.

36. A method of assembling a ball grid array (BGA) package, comprising the steps of:

providing a substrate that has a first surface and a second surface;  
providing at least one opening in a stiffener from a first surface of the stiffener to the second surface of the stiffener;  
attaching the first stiffener surface to the first substrate surface;  
mounting an integrated circuit (IC) die to the second stiffener surface, wherein a first surface of the IC die includes a contact pad,  
coupling the contact pad to the second stiffener surface;  
attaching a plurality of solder balls to the second substrate surface, inside an outer dimensional profile of the IC die; and  
coupling the plurality of solder balls through corresponding vias in the substrate to the first stiffener surface.

37. The method of claim 36, wherein the substrate includes a metal layer, wherein the metal layer is coupled to a second potential;

wherein the stiffener has at least one opening extending from the first stiffener surface to the second stiffener surface;

wherein the second IC die surface includes a second contact pad, wherein the method further comprises the step of:

5           coupling the second contact pad to the metal layer through one of the at least one openings in the stiffener and through a corresponding via that extends through the substrate.

38.    The method of claim 36, further comprising the step of:  
coupling the contact pad to a ground potential in the IC die.

10       39.    The method of claim 37, further comprising the step of:  
coupling the second contact pad to a power potential in the IC die.

40.    A method of assembling a ball grid array (BGA) package,  
comprising the steps of:

15           providing a substrate that has a first surface and a second surface;  
attaching a first surface of a stiffener to the first substrate surface;  
exposing a portion of the first stiffener surface through a window opening  
in the substrate;

          mounting an IC die to a second stiffener surface, wherein a surface of the  
IC die includes at least one contact pad; and

20           attaching a plurality of solder balls to the second substrate surface;  
configuring the exposed portion of the first stiffener surface to be coupled  
to a printed circuit board (PCB), whereby electrical and thermal performance of  
the BGA package is improved.

41.    The method of claim 40, wherein said configuring step comprises  
25       the steps of:



coupling a heat spreader to the exposed portion of the first stiffener surface; and

configuring a surface of the heat spreader to be coupled to the PCB.

42. The method of claim 41, wherein said configuring step further comprises the step of:

plating the heat spreader surface with solder to allow the heat spreader surface to be surface mounted to soldering pads on the PCB.

43. The method of claim 40, wherein said configuring step comprises the step of:

shaping the stiffener to have a centrally-located cavity shaped portion that protrudes through the window opening.

44. The method of claim 43, wherein said configuring step further comprises the step of:

plating a surface of the cavity shaped portion with solder to allow the stiffener to be surface mounted to soldering pads on the PCB.

45. The method of claim 40, further comprising the steps of:  
coupling the stiffener to a potential;  
coupling each of the at least one contact pads to the second stiffener surface with corresponding wire bonds.

46. The method of 45, wherein the stiffener coupling step comprises the steps of:

coupling the stiffener to a ground potential; and  
allowing the stiffener to serve as a ground plane.

47. A method of assembling a ball grid array (BGA) package, comprising the steps of:

providing a substrate that has a first surface and a second surface;  
attaching a first surface of a stiffener to the first substrate surface;  
mounting an IC die to the first stiffener surface;  
attaching a plurality of solder balls to the second substrate surface; and  
attaching a metal ring to the first stiffener surface.

48. The method of claim 47, wherein said metal ring attaching step comprises the step of dissipating heat from the stiffener with the metal ring.

49. The method of claim 46, further comprising the step of:  
mounting an IC die to the first stiffener surface.

50. A method of assembling a ball grid array (BGA) package, comprising the steps of:

providing a substrate that has a first surface and a second surface;  
creating a wire bond opening along each edge of an IC die mount position on a stiffener, wherein each wire bond opening extends through the stiffener;  
attaching a first surface of the stiffener to the first substrate surface;  
mounting an IC die to the IC die mount position on a second surface of the stiffener;  
bridging at least one of the wire bond openings with at least one stud; and  
attaching a plurality of solder balls to the second substrate surface.

51. The method of claim 50, wherein the IC die includes a contact pad, wherein the method further comprises the step of:

coupling the contact pad to the substrate with a wire bond, wherein the wire bond passes through one of the wire bond openings in the stiffener.

52. A method of assembling a ball grid array (BGA) package, comprising the steps of:

providing a substrate that has a first surface and a second surface;

mounting an IC die to the first substrate surface;

5 attaching a plurality of solder balls to the second substrate surface;

coupling a first surface of a heat spreader to the second substrate surface;

and

configuring a second surface of the heat spreader to be coupled to a printed circuit board (PCB).

10 53. The method of claim 52, further comprising the step of coupling the first substrate surface to the heat spreader through at least one via that extends through the substrate.

54. The method of claim 53, wherein said mounting step comprises the steps of:

15 exposing a copper plated die-attach pad to the center of the first substrate surface; and

mounting the IC die to the copper plated die-attach pad.

55. The method of claim 53, wherein said step of coupling the first substrate surface to the heat spreader comprises the steps of:

20 exposing a copper plated plane to the center of the second substrate surface; and

coupling the die-attach pad to the copper plated plane with the at least one via.

25 56. The method of claim 52, wherein said configuring step comprises the step of:

plating the second surface of the heat spreader with solder.

57. A ball grid array (BGA) package, comprising:

a substrate that has a first surface and a second surface;

a stiffener that has a first surface and a second surface, wherein said second stiffener surface is attached to said first substrate surface;

an IC die that has a first surface and a second surface, wherein said first IC die surface is mounted to said first stiffener surface;

a plurality of solder balls attached to said second substrate surface; and  
at least one of the following:

(a) a heat spreader that has a first surface, wherein said first heat spreader surface is mounted to said second IC die surface;

(b) a wire bond corresponding to a contact pad on said second IC die surface, wherein said wire bond couples said corresponding contact pad to said first stiffener surface;

(c) a window opening in said substrate that exposes a portion of said second stiffener surface, wherein said exposed portion of said second stiffener surface is configured to be coupled to a printed circuit board (PCB);

(d) a metal ring attached to said first stiffener surface; and

(e) at least one stud corresponding to a wire bond opening in said stiffener, wherein said at least one stud bridges said stiffener across said corresponding said wire bond opening.